

Title of the Device: Temperature control circuit

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#### Abstract

An electrothermal converting element 2 and a thermosensitive element 3 are put in contact with a semiconductor laser 1 and are thermally coupled. Npn transistors 4, 6 driving electric current for heating are Darlington-connected. Pnp transistors 5, 7 driving electric current for cooling are also Darlington-connected. A second positive power voltage VCC2 is applied to a collector of the transistor 6 through a resistor limiting electric current for heating 8. A second negative power voltage VEE2 is applied to a collector of the transistor 7 through a resistor limiting electric current for cooling 9. A positive power voltage VCC1 is applied to a collector of the transistor 4, and voltage for heating is applied to the electrothermal converting element 2. A negative power voltage VEE1 is applied to a collector of the transistor 5, and a voltage for cooling is applied to the electrothermal converting element 2. A operational amplifier 10 changes base voltages of the transistors 6, 7 so as to reduce the difference between the voltage of an electric signal obtained by dividing the positive voltage VCC2 and the

negative voltage VEE2 by the thermosensitive element 3 and a voltage dividing resistor 11 and a reference voltage Vref applied to a noninversion input terminal. When an electric current flows from an emitter of the transistor 4 to the electrothermal converting element 2, the semiconductor laser 1 is heated. In contrast to this, when the electric current flows from the electrothermal converting element 2 to an emitter of the transistor 5, the semiconductor laser 1 is cooled. When the power voltage begins to be applied, e.g., when the temperature of the semiconductor laser 1 is higher than the temperature at the time of equilibrium, the output of the operational amplifier 10 is negative and the electric current flows from the electrothermal converting element 2 to the emitter of the transistor 5. When this electric current is increased, the collector-emitter voltage VCE2 of the transistor 7 is reduced, the transistor 7 is saturated, and the electric current flowing through the electrothermal converting element 2 is restrained from exceeding a limit value determined in connection with the resistance value of the resistor limiting current for cooling 9. In the case of heating, the electric current flowing through the electrothermal converting element 2 is similarly restrained from exceeding a limit value determined in connection with the resistance value of the

resistor limiting current for heating 8. Thus, by arranging the resistors 8, 9 for limiting electric current, a large electric current is prevented from flowing through the electrothermal converting element 2 when power is turned on.